IEC 60384-24

Edition 3.0 2021-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fixed capacitors for use in electronic equipment – Part 24: Sectional specification – Fixed tantalum electrolytic surface mount capacitors with conductive polymer solid electrolyte

Condensateurs fixes utilisés dans les équipements électroniques – Partie 24: Spécification intermédiaire – Condensateurs fixes électrolytiques au tantale pour montage en surface à électrolyte solide en polymère conducteur

IEC 60384-24:2021-07(en-fr)

IEC Central Office
3, rue de Varembé
CH-1211 Geneva 20
Switzerland

Tel.: +41 22 919 02 11
info@iec.ch
www.iec.ch

About the IEC
The International Electrotechnical Commission (IEC) is the leading global organization that prepares and publishes International Standards for all electrical, electronic and related technologies.

About IEC publications
The technical content of IEC publications is kept under constant review by the IEC. Please make sure that you have the latest edition, a corrigendum or an amendment might have been published.

IEC publications search - webstore.iec.ch/advsearchform
The advanced search enables to find IEC publications by a variety of criteria (reference number, text, technical committee, …). It also gives information on projects, replaced and withdrawn publications.

IEC Just Published - webstore.iec.ch/justpublished
Stay up to date on all new IEC publications. Just Published details all new publications released. Available online and once a month by email.

IEC Customer Service Centre - webstore.iec.ch/csc
If you wish to give us your feedback on this publication or need further assistance, please contact the Customer Service Centre: sales@iec.ch.

IEC online collection - oc.iec.ch
Discover our powerful search engine and read freely all the publications previews. With a subscription you will always have access to up to date content tailored to your needs.

Electropedia - www.electropedia.org
The world's leading online dictionary on electrotechnology, containing more than 22 000 terminological entries in English and French, with equivalent terms in 18 additional languages. Also known as the International Electrotechnical Vocabulary (IEV) online.

A propos de l'IEC
La Commission Electrotechnique Internationale (IEC) est la première organisation mondiale qui élabore et publie des Normes internationales pour tout ce qui a trait à l'électricité, à l'électronique et aux technologies apparentées.

A propos des publications IEC
Le contenu technique des publications IEC est constamment revu. Veuillez vous assurer que vous possédez l'édition la plus récente, un corrigendum ou amendement peut avoir été publié.

Recherche de publications IEC - webstore.iec.ch/advsearchform
La recherche avancée permet de trouver des publications IEC en utilisant différents critères (numéro de référence, texte, comité d'études, …). Elle donne aussi des informations sur les projets et les publications remplacées ou retirées.

IEC Just Published - webstore.iec.ch/justpublished
Restez informé sur les nouvelles publications IEC. Just Published détaille les nouvelles publications parues. Disponible en ligne et une fois par mois par email.

Service Clients - webstore.iec.ch/csc
Si vous désirez nous donner des commentaires sur cette publication ou si vous avez des questions contactez-nous: sales@iec.ch.

IEC online collection - oc.iec.ch
Découvrez notre puissant moteur de recherche et consultez gratuitement tous les aperçus des publications. Avec un abonnement, vous aurez toujours accès à un contenu à jour adapté à vos besoins.

Electropedia - www.electropedia.org
Le premier dictionnaire d'électrotechnologie en ligne au monde, avec plus de 22 000 articles terminologiques en anglais et en français, ainsi que les termes équivalents dans 16 langues additionnelles. Egalement appelé Vocabulaire Electrotechnique International (IEV) en ligne.

IEC 60384-24

Edition 3.0 2021-07

INTERNATIONAL STANDARD

NORME INTERNATIONALE

Fixed capacitors for use in electronic equipment –
Part 24: Sectional specification – Fixed tantalum electrolytic surface mount capacitors with conductive polymer solid electrolyte

Condensateurs fixes utilisés dans les équipements électroniques –
Partie 24: Spécification intermédiaire – Condensateurs fixes électrolytiques au tantale pour montage en surface à électrolyte solide en polymère conducteur

INTERNATIONAL
ELECTROTECHNICAL
COMMISSION

COMMISSION
ELECTROTECHNIQUE
INTERNATIONALE

ICS 31.060.40; 31.060.50

ISBN 978-2-8322-9978-4

CONTENTS

INTERNATIONAL ELECTROTECHNICAL COMMISSION

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 24: Sectional specification – Fixed tantalum electrolytic surface mount capacitors with conductive polymer solid electrolyte

FOREWORD

1) The International Electrotechnical Commission (IEC) is a worldwide organization for standardization comprising all national electrotechnical committees (IEC National Committees). The object of IEC is to promote international co-operation on all questions concerning standardization in the electrical and electronic fields. To this end and in addition to other activities, IEC publishes International Standards, Technical Specifications, Technical Reports, Publicly Available Specifications (PAS) and Guides (hereafter referred to as "IEC Publication(s)"). Their preparation is entrusted to technical committees; any IEC National Committee interested in the subject dealt with may participate in this preparatory work. International, governmental and non-governmental organizations liaising with the IEC also participate in this preparation. IEC collaborates closely with the International Organization for Standardization (ISO) in accordance with conditions determined by agreement between the two organizations.

2) The formal decisions or agreements of IEC on technical matters express, as nearly as possible, an international consensus of opinion on the relevant subjects since each technical committee has representation from all interested IEC National Committees.

3) IEC Publications have the form of recommendations for international use and are accepted by IEC National Committees in that sense. While all reasonable efforts are made to ensure that the technical content of IEC Publications is accurate, IEC cannot be held responsible for the way in which they are used or for any misinterpretation by any end user.

4) In order to promote international uniformity, IEC National Committees undertake to apply IEC Publications transparently to the maximum extent possible in their national and regional publications. Any divergence between any IEC Publication and the corresponding national or regional publication shall be clearly indicated in the latter.

5) IEC itself does not provide any attestation of conformity. Independent certification bodies provide conformity assessment services and, in some areas, access to IEC marks of conformity. IEC is not responsible for any services carried out by independent certification bodies.

6) All users should ensure that they have the latest edition of this publication.

7) No liability shall attach to IEC or its directors, employees, servants or agents including individual experts and members of its technical committees and IEC National Committees for any personal injury, property damage or other damage of any nature whatsoever, whether direct or indirect, or for costs (including legal fees) and expenses arising out of the publication, use of, or reliance upon, this IEC Publication or any other IEC Publications.

8) Attention is drawn to the Normative references cited in this publication. Use of the referenced publications is indispensable for the correct application of this publication.

9) Attention is drawn to the possibility that some of the elements of this IEC Publication may be the subject of patent rights. IEC shall not be held responsible for identifying any or all such patent rights.

International Standard IEC 60384-24 has been prepared by IEC technical committee 40: Capacitors and resistors for electronic equipment.

This third edition cancels and replaces the second edition published in 2015. This edition constitutes a technical revision.

This edition includes the following significant technical changes with respect to the previous edition:

a) Revision of the structure in accordance with ISO/IEC Directives, Part 2:2018, to the extent practicable, and harmonization between other similar kinds of documents.

b) In addition, Clause 5 and all the tables have been reviewed in order to prevent duplications and contradictions.

The text of this standard is based on the following documents:

FDIS	Report on voting
40/2849/FDIS	40/2860/RVD

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this International Standard is English.

A list of all parts in the IEC 60384 series, published under the general title *Fixed capacitors for use in electronic equipment*, can be found on the IEC website.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at http://www.iec.ch/standardsdev/publications.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

FIXED CAPACITORS FOR USE IN ELECTRONIC EQUIPMENT –

Part 24: Sectional specification – Fixed tantalum electrolytic surface mount capacitors with conductive polymer solid electrolyte

1 Scope

This part of IEC 60384 applies to fixed tantalum electrolytic surface mount capacitors with conductive polymer solid electrolyte, which are primarily intended for DC applications for use in electronic equipment.

Fixed tantalum electrolytic surface mount capacitors with solid (MnO_2) electrolyte are not included but are covered by IEC 60384-3.

These capacitors are primarily intended for use in electronic equipment to be mounted directly on substrates for hybrid circuits or to printed boards.

Capacitors for special-purpose applications can need additional requirements.

The object of this document is to prescribe preferred ratings and characteristics and to select from IEC 60384-1:2016 the appropriate quality assessment procedures, tests and measuring methods and to give general performance requirements for this type of capacitor.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

IEC 60063, *Preferred number series for resistors and capacitors*

IEC 60068-1:2013, *Environmental testing – Part 1: General and guidance*

IEC 60384-1:2016, *Fixed capacitors for use in electronic equipment – Part 1: Generic specification*

IEC 61193-2:2007, *Quality assessment systems – Part 2: Selection and use of sampling plans for inspection of electronic components and packages*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in IEC 60384-1:2016 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- IEC Electropedia: available at http://www.electropedia.org/
- ISO Online browsing platform: available at http://www.iso.org/obp

3.1
capacitance
<electrolytic capacitor> capacitance of an equivalent circuit whose capacitance and resistance in series is measured with an alternating current having an approximately sinusoidal waveform at a specified frequency

4 Preferred ratings and characteristics

4.1 Preferred characteristics

Preferred climatic categories only shall be given in the preferred characteristics.

The capacitors covered by this sectional specification are classified into climatic categories in accordance with the general rules given in IEC 60068-1:2013, Annex A.

The lower and upper category temperature shall be taken from the following:

- lower category temperature: −55 °C;
- upper category temperature: +105 °C and +125 °C.

The severities for the cold and dry heat tests are the lower and upper category temperatures respectively.

The upper category temperature shall be 105 °C or 125 °C for a rated temperature of 85 °C.

The upper category temperature shall be 125 °C for a rated temperature of 105 °C.

4.2 Preferred values of ratings

4.2.1 Nominal capacitance (C_N)

Preferred values of nominal capacitance are indicated in microfarad (µF).

Preferred values of nominal capacitance shall be taken from the E 12 series of IEC 60063 as follows:

1,0 – 1,2 – 1,5 – 1,8 – 2,2 – 2,7 – 3,3 – 3,9 – 4,7 – 5,6 – 6,8 – 8,2;

and their decimal multiples (× 10^n, n: integer).

4.2.2 Tolerance on nominal capacitance

Preferred value of tolerance on nominal capacitance is:

±20 %.

4.2.3 Rated voltage (U_R)

Preferred values of rated DC voltages taken from R10 and R20 series of ISO 3 are:

– from R10: 1,0 – 1,25 – 1,6 – 2,0 – 2,5 – 4,0 – 5,0 – 6,3 – 8,0;
– from R20: 3,5[1];
– and their decimal multiples (× 10^n, n: integer).

[1] ISO 3 indicates the value 3,55 for R20.

4.2.4 Category voltage (U_C)

The category voltage for capacitors is given in Table 1 and Table 2.

4.2.5 Surge voltage (U_{RS} or U_{CS})

The surge voltage shall be 1,15 times the rated or category voltage rounded off to the nearest volt (two significant digits) (see Table 1 and Table 2).

NOTE U_{RS} is the surge voltage to rated voltage;
U_{CS} is the surge voltage to category voltage.

4.2.6 Rated temperature

The value of the rated temperature is +85 °C and +105 °C (see Table 1 and Table 2).

Table 1 – Category and surge voltages

Values in volts

	Upper category temperature 125 °C / rated temperature 85 °C											
U_R	2,0	2,5	4,0	5,0	6,3	8,0	10	12,5	16	20	25	35
U_C = 0,80 U_R	1,6	2,0	3,2	4,0	5,0	6,4	8,0	10	13	16	20	28
U_{RS}	2,3	2,9	4,6	5,8	7,2	9,2	12	14	18	23	29	40
U_{CS}	1,8	2,3	3,7	4,6	5,8	7,4	9,2	12	15	18	23	32

Table 2 – Category and surge voltages

Values in volts

	Upper category temperature 125 °C / rated temperature 105 °C or upper category temperature 105 °C / rated temperature 85 °C											
U_R	2,0	2,5	4,0	5,0	6,3	8,0	10	12,5	16	20	25	35
U_C = 0,90 U_R	1,8	2,3	3,6	4,5	5,7	7,2	9,0	11	14	18	23	32
U_{RS}	2,3	2,9	4,6	5,8	7,2	9,2	12	14	18	23	29	40
U_{CS}	2,0	2,6	4,1	5,2	6,5	8,2	10	13	16	20	26	36

5 Test and measurement procedures

5.1 General

Test severities and requirements prescribed in detail specifications referring to this sectional specification are of equal or higher performance level, because lower performance levels are not permitted.

This clause supplements the information given in IEC 60384-1:2016, Clause 4.

5.2 Preliminary drying

See IEC 60384-1:2016, 4.3.

5.3 Measuring conditions

See IEC 60384-1:2016, 4.2.1.

5.4 Mounting

5.4.1 General

See IEC 60384-1:2016, 4.33, with 5.4.2, 5.4.3 and 5.4.4 of this document.

5.4.2 Initial inspections

See Table 4.

5.4.3 Test conditions

The test method shall be the reflow method and reflow temperature profile specified in the detail specification.

5.4.4 Final inspections and requirements

See Table 4.

5.5 Visual examination and check of dimensions

5.5.1 General

See IEC 60384-1:2016, 4.4, with 5.5.2 and 5.5.3 of this document.

5.5.2 Visual examination and check of dimensions

Visual examination shall be carried out with suitable equipment with approximately 10× magnification and lighting appropriate to the specimen under test and the quality level required. The operator should have available facilities for incident or transmitted illumination, as well as an appropriate measuring facility. The capacitors shall be examined to verify that the materials, design, construction, and physical dimensions are appropriate.

5.5.3 Requirements

The workmanship shall be in accordance with the applicable requirements given in the detail specification.

5.6 Electrical tests

5.6.1 Leakage current

5.6.1.1 General

See IEC 60384-1:2016, 4.9, with 5.6.1.2 and 5.6.1.3 of this document.

5.6.1.2 Measuring conditions

The rated voltage shall be applied across the capacitor and its protective resistor placed in series with the capacitor to limit the charging current.

The protective resistor shall have a value of 1 000 Ω.

5.6.1.3 Requirements

See Table 4.

5.6.2 Capacitance

5.6.2.1 General

See IEC 60384-1:2016, 4.7, with 5.6.2.2 and 5.6.2.3 of this document.

5.6.2.2 Measuring conditions

Unless otherwise specified in the detail specifications, the capacitance shall be measured at a frequency of 100 Hz or 120 Hz.

The peak alternating voltage actually applied across the capacitor terminations shall not exceed 0,5 V (RMS).

A DC bias voltage of 0,7 V to 1,0 V may be applied during the measurement to avoid negative voltage application to the capacitor by the applied AC voltage.

The inaccuracy of the measuring instruments shall not exceed ±2 % of the limit specified in the detail specification, whether this is given as an absolute value or as a change of capacitance.

5.6.2.3 Requirements

See Table 4.

5.6.3 Tangent of loss angle (tan δ)

5.6.3.1 General

See IEC 60384-1:2016, 4.8.1, with 5.6.3.2 and 5.6.3.3 of this document.

5.6.3.2 Measuring conditions

The measurement shall be under the conditions as specified in 5.6.2.2.

The inaccuracy of the measuring equipment shall not exceed 0,01 in absolute value.

5.6.3.3 Requirements

See Table 4.

5.6.4 Equivalent series resistance (ESR) (if required)

5.6.4.1 General

See IEC 60384-1:2016, 4.8.2, with 5.6.4.2 and 5.6.4.3 of this document.

5.6.4.2 Measuring conditions

Unless otherwise specified in the detail specifications, test conditions are as follows:

– temperature: 20 °C ± 2 °C;
– applied voltage: peak AC value ≤ 0,5 V (RMS);
– voltage frequency: 100 kHz ± 10 kHz.

The error of measurement shall not exceed 5 % of the requirement, or 0,02 Ω, whichever is the greater.

5.6.4.3 Requirements

See Table 4.

5.7 Resistance to soldering heat

5.7.1 General

See IEC 60384-1:2016, 4.14, with 5.7.2 to 5.7.5 of this document.

5.7.2 Initial inspections

See Table 4.

5.7.3 Test conditions

The test method shall be the reflow method, and the reflow temperature profile shall be specified in the detail specification.

5.7.4 Recovery

The recovery period shall be 24 h ± 2 h.

5.7.5 Final inspections and requirements

After recovery, the capacitors shall be visually examined under normal lighting and approximately 10× magnification and measured electrical characteristics given in Table 4.

5.8 Solderability

5.8.1 General

See IEC 60384-1:2016, 4.15, with 5.8.2 of this document.

5.8.2 Final inspections and requirements

See Table 4.

5.9 Shear test

See IEC 60384-1:2016, 4.34.

5.10 Substrate bending test (if required)

5.10.1 General

See IEC 60384-1:2016, 4.35, with 5.10.2 to 5.10.4 of this document.

5.10.2 Initial inspections

See Table 4.

5.10.3 Test conditions

Deflection D and the number of bends shall be specified in the detail specification.

5.10.4 Final inspections and requirements

See Table 4.

5.11 Rapid change of temperature

5.11.1 General

See IEC 60384-1:2016, 4.16, with 5.11.2 to 5.11.5 of this document.

The capacitors shall be mounted in accordance with 5.4.

5.11.2 Initial inspections

See Table 4.

5.11.3 Test conditions

Test conditions are as follows:

– T_A = lower category temperature;
– T_B = upper category temperature;
– the capacitors shall be tested for 5 cycles;
– the duration of the exposure at each temperature limit shall be 30 min.

5.11.4 Recovery

The recovery period shall be 1 h to 2 h.

5.11.5 Final inspections and requirements

See Table 4.

5.12 Climatic sequence

5.12.1 General

See IEC 60384-1:2016, 4.21, with 5.12.2 to 5.12.8 of this document.

5.12.2 Initial inspections

See Table 4.

5.12.3 Dry heat

See IEC 60384-1:2016, 4.21.3, with the following details:

– temperature: upper category temperature;
– duration: 16 h.

5.12.4 Damp heat, cyclic, test Db, first cycle

See IEC 60384-1:2016, 4.21.4.

5.12.5 Cold

See IEC 60384-1:2016, 4.21.5, with the following details:

– temperature: lower category temperature;
– duration: 2 h.